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# PATENT SPECIFICATION

DRAWINGS ATTACHED

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## COMPLETE SPECIFICATION

### Multi-Coloured Illuminated Display Means

- We, CLARKE CHAPMAN & COMPANY LIMITED, a British Company of Victoria Works, Gateshead 8, County Durham, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- The present invention relates to control means for the multi-coloured illuminated public display of either static or moving pictures or symbols (letters and numbers) such as for example pictures used in advertising, or written information.
- It has been proposed to use light sensitive means, effective upon energization, to cause relay means to connect an electric light bulb to a power source and thus illuminate the bulb.
- It has further been proposed to use solid state switches, such as silicon controlled rectifiers, which are operated by full wave rectified alternating voltages which are conduction angle controlled to allow variable control of illumination.
- According to the present invention there is provided illuminated multi-colour display means comprising for each colour, a plurality of light sensitive means, an identical number of appropriately coloured electric light bulbs arranged on a display panel, an identical number of pairs of back-to-back connected conduction controlled devices (as hereinafter defined) in series with the lamps and a source of alternating voltage means for generating pulses to unblock alternately a conduction controlled device of each pair through its control electrode for a period depending upon the intensity of illumination of the light sensitive means, the degree of illumination of the bulb being proportional to the time period for which the conduction controlled device is in the unblocked state, which may extend for any part of a half cycle period of the supply voltage.
- The term conduction controlled device is herein defined as a device, the conduction period of which, within a particular time period is controlled by an external source.
- The conduction controlled devices may be silicon controlled rectifiers.
- The means for controlling the degree of illumination may comprise a measuring amplifier into which an error voltage derived from the difference between a fixed reference voltage and a voltage derived from the light sensitive means is fed into the said measuring amplifier delivering an output pulse to trigger the pulse generating means.
- The present invention will now be described in greater detail by way of example with reference to the accompanying drawings, wherein:—
- Fig. 1 shows a circuit diagram of a preferred form of control means for the multi-coloured illuminated display of pictures, the Fig. illustrating the control means for only one colour;
- Fig. 1A shows 5 waveforms (a) to (e) which explain the operation of the circuit shown in Fig. 1;
- Fig. 2 shows the solid state switch shown in Fig. 1 in greater detail;
- Fig. 3 shows a block schematic diagram of a modified construction of the control means shown in Fig. 1;
- Fig. 4 shows a schematic diagram of one preferred form of the whole apparatus which incorporates the control means of Fig. 1; and
- Fig. 5 shows a schematic diagram of an

[Pr |

alternative system for controlling the multi-coloured display.

Referring first to Fig. 4, the multi-coloured display assembly comprises a display assembly 15 on which a plurality of groups of light bulbs 14 are arranged in rows and columns each group comprising five different coloured bulbs, five picture projectors 18, five projection screens 17, each containing as many light sensitive resistors 4(l) to 4(m) (Fig. 1) as there are bulbs 14, on the display assembly 15 for that colour, the resistors being arranged in groups in columns and rows exactly in the same pattern as the bulbs 14 are arranged. In each screen 17, each resistor 4 is connected in the input circuit of a separate control unit 16 these control units all being fed with a direct voltage from a stabilized source 5. Thus, there are five separate stabilized sources 5 (one for each colour) and a total of  $5n$  control units 16, where  $n$  is the total number of groups of resistors 4 on the screen 17.

Each projector 18 projects a picture from a black and white negative, the white indicating the particular colour to be displayed. The individual control units 16, for one colour display are shown in greater detail in Fig. 1. The direct voltage stabilizer source 5 is fed with an alternating voltage (waveform *a*), the direct voltage output of which is supplied to a series of bridge arms in parallel, there being  $(n+1)$  arms for  $n$  control units 16. The first arm comprising resistors 1 and 2 constitutes a reference arm, a reference potential, which can be varied by adjusting the value of the resistor 2, being obtained from the point *e*. The second arm comprises a resistor 3(l) and the resistor 4(l) and constitutes the measuring arm for the first control unit 16. The measured potential is taken from the point *f*. The outputs from the potential points *e* and *f* are fed on two separate inputs to a measuring amplifier 10. This amplifier 10 is controlled by a further input which receives a full wave rectified voltage from a constant current source (not shown) (waveform *b*). This voltage is obtained from the alternating voltage (waveform *a*). This voltage is used to charge up a capacitor (not shown) which is located within the amplifier 10. The capacitor is charged up linearly by means of the constant current source. The measuring amplifier 10 measures the difference between the two voltages at the points *e* and *f*. This difference voltage is hereinafter referred to as the error voltage. This error voltage is used to control the constant current source value. At the point at which the magnitude of the voltage across the capacitor exceeds an internally generated voltage, an output pulse from the measuring amplifier 10 is applied to a pulse generator 11. The pulse generator 11 provides two separate outputs when triggered from the measuring amplifier 10, these outputs being obtained at 180° phase

difference during each complete alternating voltage cycle (waveforms *c* and *d*). The capacitor is discharged by the output pulse from the amplifier 10 so that it is caused to discharge completely before the beginning of the next half cycle. The time taken for the voltage across the capacitor to reach the internally generated voltage applied to the amplifier is therefore a function of the error voltage. The pulses obtained on the two outputs from the pulse generator 11 are respectively fed to the control electrodes of two solid state switches 12 connected in back-to-back arrangement in series with the bulb 14 across the same alternating voltage supply as that connected to the direct voltage source 5. These solid state switches are preferably silicon controlled rectifiers. The voltage applied to the bulb 14 is shown in waveform (*e*). The electronic control means comprises as many measuring amplifiers 10, pulse generators 11, and back-to-back pairs of solid state switches 12 as there are light sensitive resistors 4 and bulbs 14 for the colour concerned. Also there are an equal number of measuring arms, containing the resistors 3(2) to 3(m) and the resistors 4(2) to 4(m), whose outputs are taken from the points *g*, *h*, . . . *z* and applied to one input of the measuring amplifiers 10. The output from the point *e* of the reference arm is applied to the other input of each amplifier 10.

In the above described example, five colours are used. These may be white, red, blue, green and yellow. Black may be obtained if none of bulbs in a group are illuminated. Of course, any other number of colours may be used instead.

Since the resistance of a light sensitive resistor 4 varies as a function of the intensity of light falling on it the intensity of illumination produced by a bulb 14 is proportional to the projected light intensity falling on the associated resistor 4.

In a modified form shown in Fig. 3, the input is an e.m.f. generating device 13 having a light sensitive component, the e.m.f. being a direct voltage which is applied directly to the amplifier 10. The generated e.m.f. of the device 13 is proportional to the projected light falling on it.

In an alternative arrangement a photo diode or photo transistor may constitute the light sensitive component and the e.m.f. generating device 13 as the input device. Each of the devices have parameters which are variable proportional to the light intensity falling on them.

By making the resistor 2 as a variable component, the overall peak light intensity of all the bulbs 14 for each colour may be varied since this causes the reference potential at the point *e* to be made variable. It is also possible to modify the circuit by making the resistor 2 a light sensitive element itself so that it can

measure the ambient light in each colour around the display assembly 15, thus causing the ratio of peak light intensity of display bulbs to ambient light intensity to remain a constant value for that colour.

Referring now to Fig. 5, which shows an alternative system for controlling the multi-coloured display, instead of providing a separate projector 18 and screen 17 for each colour to be displayed, only one projector 18 is employed, this projector projecting a coloured picture on a single screen 17. The light sensitive resistors 4 are all arranged on this screen in groups, the groups being in corresponding arrangement with the coloured bulbs 14. Each group consists of five resistors 4, one for each of the five colours to be displayed. In front of each resistor 4 there is located a filter, a red filter for the resistor which is to respond to red light, a blue filter for the resistor which is to respond to blue light etc. Apart from the above differences this system is identical with that described in connection with Figs. 1 and 4. Where white light is projected onto the screen, it will cause all the resistors 4 to switch on their associated solid state switches 12.

#### WHAT WE CLAIM IS:—

1. Illuminated multi-colour display means comprising for each colour, a plurality of light sensitive means, an identical number of appropriately coloured electric light bulbs arranged on a display panel, an identical number of pairs of back-to-back connected conduction controlled devices (as hereinbefore defined) in series with the lamps and a source of alternating voltage, means for generating pulses to unblock alternately a conduction controlled device of each pair through its control electrode, for a period depending on the intensity of illumination of the light sensitive means, the degree of illumination of the bulb being proportional to the time period for which the conduction controlled device is in the unblocked state.

2. Illuminated multi-colour display means according to claim 1 wherein the conduction controlled devices are silicon controlled rectifiers.

3. Illuminated multi-colour display means according to claim 1 or 2, wherein the degree of illumination is controlled by a measuring amplifier into which an error voltage derived from the difference between a fixed reference voltage and a voltage derived from the light sensitive means is fed into the said measuring amplifier delivering an output pulse to trigger the pulse generating means.

4. Illuminated multi-colour display means

according to claim 3, wherein the fixed reference voltage is obtained from a reference arm of a bridge circuit comprising  $(n+1)$  bridge arms parallel, wherein  $n$  is the number of the plurality, the other  $n$  arms of the bridge circuit each including a light sensitive resistor and a variable resistor, the junction between each light sensitive resistor and the variable resistor being connected to one input of the respective amplifier, the other input of each amplifier being connected to the centre point of the reference arm.

5. Illuminated multi-colour display means according to claim 1 or 2, wherein the degree of illumination is controlled by a measuring amplifier and an e.m.f. generating device, the e.m.f. generating device having a component which is sensitive to the light falling on it, the output of the e.m.f. device which is a direct voltage proportional to the magnitude of the light fall on the component, being fed direct to the measuring amplifier.

6. Illuminated multi-colour display means according to claim 5 wherein the light sensitive component and e.m.f. generating device are constituted by a photo diode or photo transistor.

7. Illuminated multi-colour display means according to any one of the preceding claims wherein the display means includes as many projectors as there are colours to be projected and an equal number of screens in which are located the plurality of light sensitive means aligned in rows and columns.

8. Illuminated multi-colour display means according to any one of the preceding claims 1 to 6, wherein the display means includes a single projector and a screen the screen having groups of light sensitive means arranged thereon in rows and columns, each group having as many light sensitive means as there are colours to be projected, each having an appropriate filter placed in front of it so that each is only sensitive to its allotted colour.

9. Illuminated multi-colour display means constructed substantially as herein described with reference to and as illustrated in Figs. 1, 2 and 4, or Figs. 2, 3 and 4, or Figs. 1, 2 and 5 of the accompanying drawings.

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Agents for the Applicants.

Reference has been directed in pursuance of Section 9, subsection (1) of the Patents Act, 1949, to patent No. 1,052,372.

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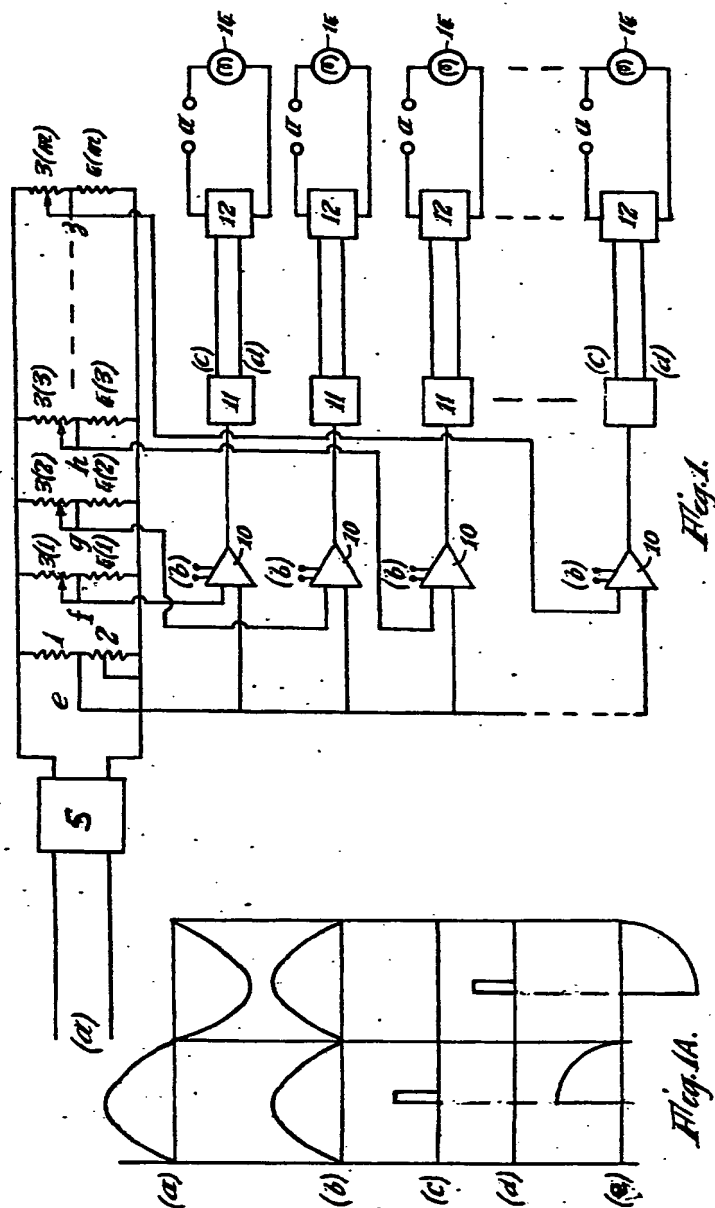
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3 SHEETS

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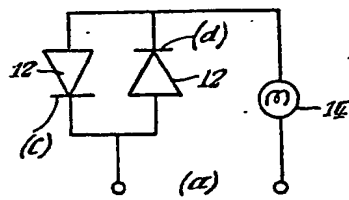


Fig. 2.

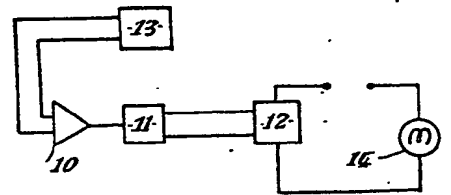


Fig. 3.

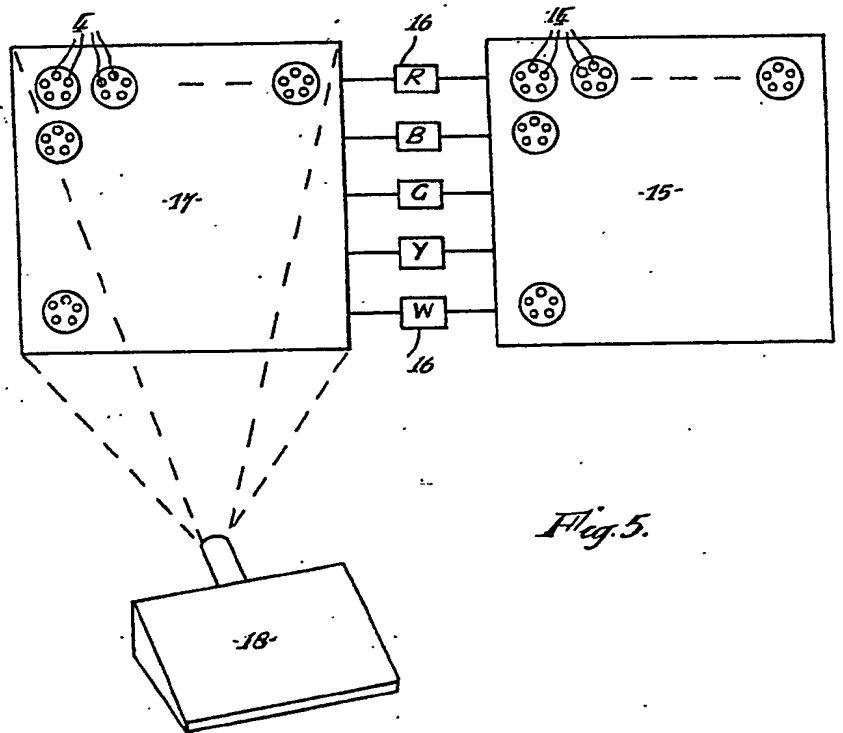


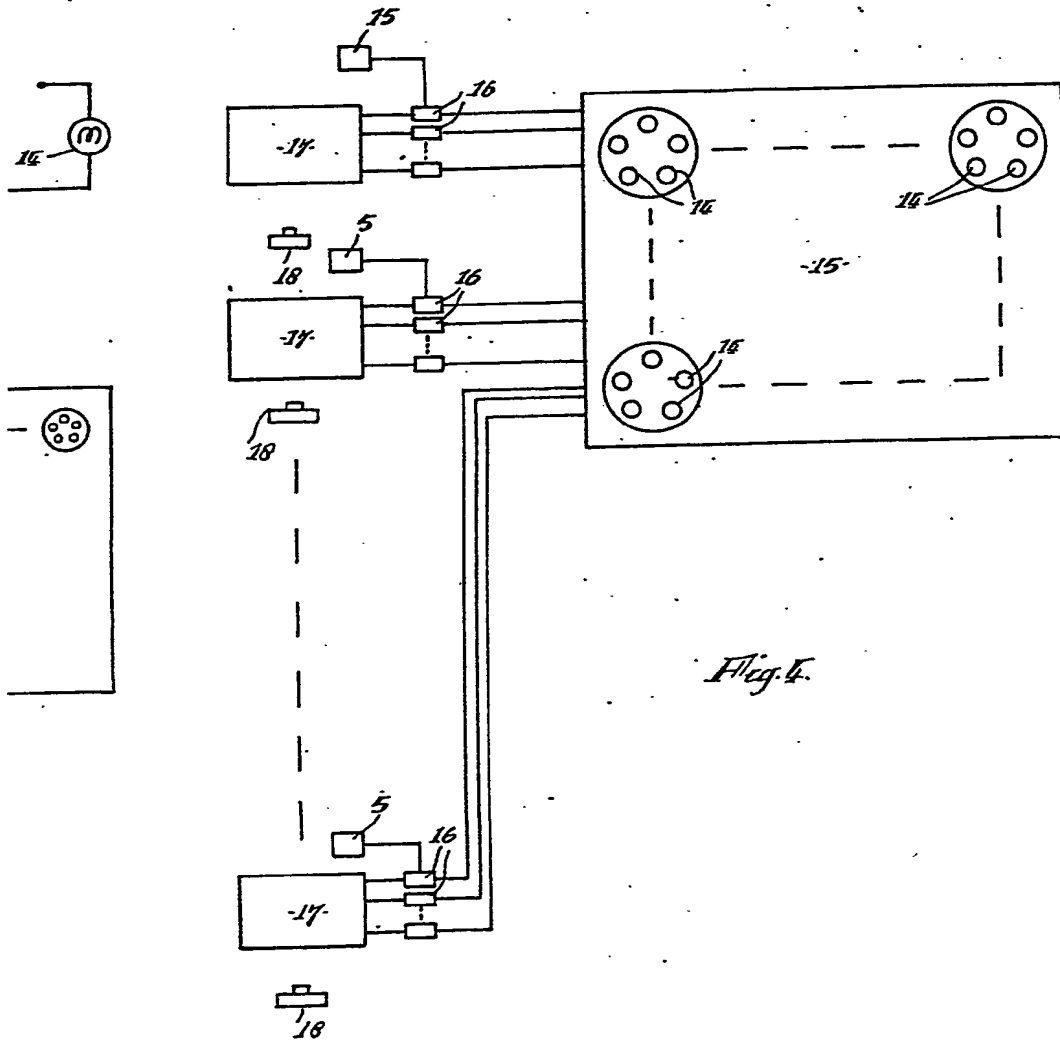
Fig. 5.

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3 SHEETS

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 3 SHEETS Sheets 2 & 3

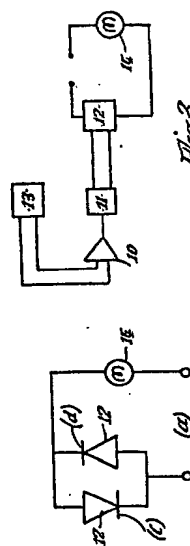


Fig. 3.

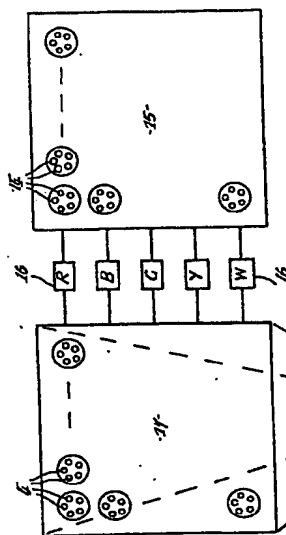


Fig. 5.

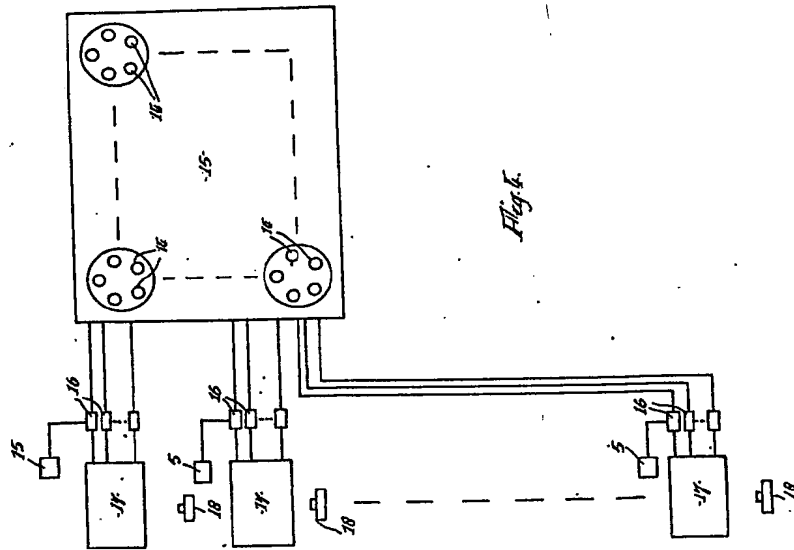


Fig. 6.

